

Incentivized time preferences, level of education in a household and financial literacy: Laboratory evidence.

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Abstract

Time preferences can explain one's ability to exercise self-control, patience and perseverance, qualities which are critical for improved welfare and making investment choices. The study investigates the impact of financial literacy level, highest level of education in a household and gender differences on time preferences of university students. University students constitute a significant group of young people who will, in the immediate future, join the working class and/or make investment as well as saving decisions. The study relies on a purposive sample of (N=85, female=48%) university students pursuing a financial literacy course at a university in South Africa. The study uses a questionnaire, a financial literacy test and a simple binary choice time discount rate eliciting game to gather data. Ten percent of the participants were paid (in South African rands) for their time preference choices by way of quota random sampling. Female respondents' time discount rate is on average higher than that of their male counterparts. A Negative Binomial and Ordinary Least Squares regression analysis showed that time preferences of sampled university students are significantly influenced by highest level of education in a household and gender differences. Financial literacy has a significant impact on time preferences of male respondents but the same could not be confirmed for female respondents. Income, age, financial literacy perceptions and family size also significantly influenced time preferences. Highest level of education in a household and gender differences have a bearing on individual time preferences.

Key words: Time preferences, financial literacy, education, time discount rate, gender, impatient

JEL Classification: D14; C19; D99; G11; I22

1. INTRODUCTION

Time preferences can reveal one's levels of patience and self-control, attributes which are critical in making financial investments and choices. The pleasure of consuming goods immediately as opposed to the discomfort of future consumption is mainly influenced by the circumstances in which decision-makers find themselves (DellaVigna, 2009; Frederick et al., 2002; Loewenstein et al., 2003; Rae and Mixter, 1905). Research evidence suggests that individuals' time preferences are highly correlated with financial literacy-information acquisition, job search for a long period, earning of higher wages, preparation to take up contingency measures to improve future welfare and generally better financial outcomes (DellaVigna, 2009; Meier and Sprenger, 2013).

Time preferences have been used to explain economic concepts such as credit card take up, life cycle savings, retirement savings, procrastination, homework and deadlines as well as perseverance by individuals (DellaVigna, 2009). Self-control and patience determine whether individuals make choices immediately, in the near future, or in the distant future. On the other hand, financial literacy according to Huston (2010) relates to measuring how well an individual can understand as well as use personal, finance-related information. The explanation makes it clear that for one to be financially literate, one should be able to use financial knowledge to improve one's welfare. This statement is further backed by Gallery *et al.* (2011) and Schagen and Lines (1996) who consider financial literacy to be the ability involved in making informed judgments and taking effective decisions regarding the use and management of money.

The definition of financial literacy suggests a variation in time preferences of people with different levels of financial literacy. The differences in welfare outcomes of people across financial levels could be explained by variations in time preferences. In reality, choices made at a given moment whether meant to accrue benefits in the present or future, are aimed at maximizing one's utility; therefore, one's financial knowledge might be an important factor. Further, presenting incentives in the form of actual money payment on the choices made by individuals can be seen as the setting up of a practical life situation conducive to displaying true time preference behaviour.

This study investigates the impact of financial literacy, highest level of education in a household and gender differences on time preference in a laboratory experiment set up. The discrete nature of time discount rates allows the study to use the Negative Binomial regression method to analyse data. An Ordinary Least Squares model with an interacted variable of time discount rate and financial literacy is also used in the investigation. A total purposive sample of 85 students took part in a financial literacy test and time preference game that was included in a questionnaire. The questionnaire included a simple binary choice time preference experimental game using tokens which sums into a time budget (TB) in an intertemporal choice framework (Andreoni et al., 2015; Angerer et al., 2015). Students that scored a mark above the average in the financial literacy test were categorized as the high financial literacy group, whereas those that scored a mark below average represented the low financial literacy group.

The study also explores whether the state of world where respondents survive in influence their time preferences. The state of the individual's world may include gender orientation and family status among others. In a society which participates in intertemporal choice decision making, university students are an important group because of their level of financial literacy, therefore, it is critical to understand the determinants of their time preferences. In addition, students are

the most logical next entrant into the job market where saving and investment decisions are equally vital. Ten percent of the participants were randomly selected and paid the actual amounts of their choices using quota random sampling, according to the instruction on the time preference game. The random incentivized system allows all participants a fair and equal chance of being selected for payment.

A number of studies have explored the level of financial literacy across gender, economic status, social status and area of specialization (Batty et al., 2014; Lusardi et al., 2010; Mandell, 2008; Shambare and Rugimbana, 2012; Oanea and Dornean, 2012). Very little information is available regarding the interaction between one's financial literacy level, gender differences and the time discount rate as a measure of time preferences. The fact that financial literacy attainment yields better welfare outcomes cannot be doubted (Becchetti et al., 2013; Sayinzoga et al., 2014; Tang and Peter, 2015). What is not clear, however, is how financial literacy affect one's level of patience or impatience, which is measured by one's time discount rate. The level of patience (or impatience) allows individuals to gainfully use financial literacy acquired to improve current and future welfare (Carlin and Robinson, 2010).

This study is outlined as follows; the next section presents a review of literature, followed by a discussion of the methodology, data analysis and presentation of results. The final section provides the conclusion of the study.

2. LITERATURE REVIEW

The quest to understand what drives time preferences has been a subject of debate to researchers (Capuano and Ramsay, 2011; Frederick et al., 2002; Hoch and Loewenstein, 1991; Loewenstein and Thaler, 1989). Although time discount rate is used to measure time preferences, a number of factors are known to influence time preferences; namely, habit formation, affection, anticipatory utility and visceral influences (Frederick et al., 2002). Neoclassical economics holds that exhibiting an optimal behaviour is an aspect of rational choice (Mas-Colell et al., 1995). Predictable, yet irrational behaviour exhibited by consumers is mainly driven by knowledge and psychological processes that create mental "shortcuts" as well as biases (Smith and Barboza, 2014). Beside neoclassical suggestions, human beings have exhibited time-inconsistent behaviour, which is an aspect of irrationality (Hoch and Loewenstein, 1991; İmrohoroğlu et al., 2003; Loewenstein and Thaler, 1989). Students' social upbringing, cognitive ability, circumstances and the surrounding environment can play an important role in determining their time preferences.

Preferences in general influence supply and demand of goods, a fact that has incentivized researchers to gain greater insight into how preferences are formulated (Ariely et al., 2003). Measuring time preferences has generally presented challenges to researchers and no single method is absolved of errors in measuring discount rates (Loewenstein et al., 2003). A number of researchers have tended to use laboratory experiments in trying to explain time preferences in real life situations (Ariely and Wertenbroch, 2002; Ausubel, 1999). Their findings reveal that individuals make time preference choices that maximize their utility and resemble real life behaviour.

There has also been a concerted effort to test whether laboratory experiment findings explain real behaviour of subjects in the practical world. The general consensus is that the measured time preferences lack the scope to explain actual human behaviour (Chabris et al., 2008).

However, a number of researchers concluded a close relationship between experimental research findings and true human time preference choices (Benzion et al., 1989; Charness et al., 2013; Meier and Sprenger, 2013). A research project in the district of Georgia in the US in 2008 concluded that drop-outs and referrals were positively correlated with impatient behaviour (Castillo et al., 2011). The findings are, however, inconclusive in that the research project could not identify precisely what drives individual and group time preferences.

On the other hand, financial literacy has been hailed for improving welfare of individuals and society. A study on elementary school students by Batty *et al.* (2014) found that financial education impacted attitudes. The findings indicate that one's level of financial literacy influences how one makes intertemporal choices and that financial knowledge influences time preferences. In addition to their findings, students that were exposed to financial literacy were able to save and were financially savvy. Another aspect that has been found to be important in moulding intertemporal choices is family background. In a study by (Sabri et al., 2010) carried out in Malaysia, students that received financial literacy from their parents exhibited better financial outcomes and were more likely to save money. This suggests that knowledge within a household plays a pivotal role in shaping time preferences.

Time preferences represent an aspect of intertemporal choice and researchers have investigated how it is impacted by financial literacy level as well as gender orientation. In short, time preferences reveal one's choices over time while financial literacy has more to do with financial knowledge and the ability to apply financial knowledge (Loewenstein et al., 2003;Huston, 2010). The direction of causality between financial literacy and time preferences seems difficult to tell, however, evidence suggests interaction of the two influences life outcomes. Meir and Sprenger (2013) conducted an incentivized multiple price list experiment on individuals participating in volunteer income tax assistance (VITA) credit counselling programme and concluded that participants in the VITA program had a higher discount rate, suggesting that people who sought information were generally impatient. Research evidence suggest variation in time preferences across gender. For example, a research study investigating time preferences of high school students carried by Castillo *et al.* (2011) concluded that boys compared to girls had a higher discount rate - suggesting impatience amongst boys.

Gender differences are mainly driven by variation in preferences (Laasch and Conaway, 2009). An increased number of literature on risk preferences found out that women are more risk averse compared to men (Charness and Gneezy, 2012; Eckel and Grossman, 2008; Powell and Ansic, 1997). Beside observing differences in risk preferences across gender there is also evidence of variation in time preferences by gender and race (Norum, 2008; Adan and Natale, 2002). Married women were concluded to be investing less in common stock than married men (Bajtelsmit et al., 1999). However, there are some studies that could not conclude variation in time preferences (Kim et al., 2002). In a research study comparing risk and time preferences among students in the USA, no differences were found across gender (Bernheim et al., 2001). Evidence from previous work on time preferences and education remain inconclusive.

Financial literacy is a form of education on financial concepts. Research has concluded a correlation between education and time preferences (Pol, 2011;Lawrance, 1991; Fuchs, 1980). Pol (2011) and Lawrance (1991) observed that time preferences tend to decrease as the level of education increases. Their studies were confined to health and poverty but did not focus on financial literacy. Financial literacy level may or may not vary across university students in

general. There is evidence of variation of financial literacy level by gender, degree being pursued, family background among others (Cull and Whitton, 2011; Lusardi et al., 2010; Chen and Volpe, 1998). Chen and Volpe (1998) found out that female students were less financially literate compared to their male counterparts. In a 2010 study in Romania, it was also concluded that male respondents had higher level of financial literacy compared to females (Oanea and Dornean, 2012). If there is a correlation between time preferences and financial literacy then, this could partially explain variation in life outcomes. On the other hand, there are studies that conclude absence of differences in financial literacy especially for university students (Wagland and Taylor, 2009).

Little research has been carried out that investigate the impact of financial literacy level on time preferences. More so, it is not clear whether there is reverse causality between financial literacy and time preferences. There is need to understand factors that influence time preferences of individuals given the fact that they play an important role in determining life outcomes. More needs to be explored with regard to time preferences and gender differences.

4. RESEARCH METHOD

The study uses the modified stylized standard model version by Rabin (2002) given below, to explain how individuals make choices over time.

$$\max_{x_i^t \in X_i} \sum_{t=0}^{\infty} \delta^t \sum_{S_t \in S_t} p(S_t) U(x_i^t | S_t) \dots \dots \dots (1)$$

Where, “individual (*i*) at time *t* maximizes expected utility subject to probability distribution $p(s)$ of the states of the world $s \in S$ ” (DellaVigna, 2009; Rabin, 2002). The utility function $U(x/s)$ is defined over pay-off of the experimental game x_i^t of subject (*i*) and future utility is discounted with a discount factor δ for naiveté assumed to be time consistent.

The discount factor δ is calculated from the choices made by the subjects given as (*columnA/columnB*), where column A is the present time pay-off received after 2 weeks and column B is a future time pay-off paid after 6 weeks, while x_i^t is the pay-off realized from the choices made and *S* the state of the subject’s world explained by financial literacy level, highest level of education in a household, financial literacy perceptions, student characteristics and the demographic information of the participants. In the study, the minimum discount rate is set at 0.1 and the maximum discount rate is set at 5.

To deal with present time bias, the initial payment is paid in the future period (Alan and Ertac, 2015) such that:

$$b_1 + \beta \delta b_2 \geq 0 \dots \dots \dots (2)$$

Where b_1 is pay-off in 2 weeks and b_2 is pay-off in 6 weeks. β represents self-control or patience problems and δ is the future utility discount rate. A Negative Binomial regression model is formulated as follows:

$$\delta(\text{time discount rate}) = f(\text{financial literacy score, financial literacy perceptions, age, highest level of education in a household, number of family members, income}).$$

The choice of the model is arrived at after considering that the dependent variables data is discrete, also variance and mean are significantly different. In addition, the choices made by

respondents range between 0.1 and 5. Financial literacy score is measured using the mark scored in the financial literacy test given before students are taught financial literacy concepts. This is the variable that measures the financial literacy level of the respondents. Financial literacy perceptions were probed in the questionnaire and responses given on a seven-point Likert scale. A single variable of perceptions is predicted using factor analysis. Self-reported age, highest level of education in the family, family size and individual income are some of the variables that were used. The highest level of education in the family is used as a proxy for family status, because number of education years have been found to be positively correlated to higher levels of income (Argent et al., 2009).

4.1 Procedure

The study used a financial literacy score test that is included in a questionnaire eliciting demographic information, financial literacy perceptions as well as time preferences. The test was administered before the students studied the financial literacy module and assisted in measuring the level of financial literacy across the respondents. A simple binary choice time preference game was used to collect students' time discount rates. A total of 85 students (female=48%) studying a financial literacy module (personal finance) at a university in South Africa were purposively sampled to participate in the study. In the time preference game, the subjects were asked to allocate five tokens between two periods; that is, after 2 weeks or after 6 weeks - resembling an investment or savings venture. The instruction for the experiment was as follows (Giné et al., 2010; Angerer et al., 2015):

“You are allocated 5 tokens. If you place the token in column A you will be paid R20 per token paid after 2 weeks. If you place the token in column B you will be paid R25 per token paid after 6 weeks. To receive payment for your choices you should pick a winning ticket from a raffle”.

To deal with the present time bias in the subject's choices a front end delay payment was used (Andersen et al., 2008). Choices for column A were paid after 2 weeks (which resembles a present time pay-off or Smaller Sooner), whereas choices for column B were paid after 6 weeks (a future period pay-off or larger later)(Andreoni and Sprenger, 2012). To select the winners, the researcher used quota sampling by way of coupons equal to the respondents that were placed in a hat. Ten percent of the coupons were stamped and whoever picked the stamped coupon was paid the amount according to his/her choices and instruction as provided in the game instruction above. The use of coupons provided all the respondents with an equal chance of winning as the coupons allowed for random sampling. The selection of ten percent of respondents is informed by previous studies (Andersen et al., 2008). The names of the winners were listed and their contact details collected for administration purposes. The information collected is aggregated for analysis and no information traceable to an individual is used. Payment to the winners was done using e-wallet, a banking platform offered by FNB bank in South Africa. The researcher paid the respondents on the days promised according to instructions of the game.

4.2 Ethical considerations

Permission to carry out the study was granted by the University Ethics Committee. Participation in the experiment was voluntary and students were allowed to stop participating in the experiment at any time. The participants were made aware of the purpose of the study. One student turned down the request to participate in the experiment and the wish was granted.

5. RESULTS AND FINDINGS

5.1 Descriptive statistics

Of the 85 subjects that participated in the study, just over half (52%) are male, while the remaining 48% are female. Self-reported evidence from the questionnaire revealed that 49% of the respondents belonged to a household with matric as the highest level of education. These are followed by 32% of the respondents that indicated that they belonged to a household with a degree as the highest level of education. About 56% of the respondents are from households with at least a matric and less. This is a clear indication that the majority of the respondents belonged to families with low levels of education.

Table 1: Descriptive statistics

Characteristics		Number of respondents	Value/percentage
Gender	All	85	100%
	Male	44	52%
	Female	41	48%
Highest level of education in the household	Less than matric	6	7%
	Matric	42	49%
	Diploma/certificate	8	9%
	Degree	27	32%
	Postgraduate	2	2%
Average test score	All	85	43%
	Male	44	43%
	Female	41	44%
Average discount rate	All	85	1.58
	Male	44	1.21
	Female	41	1.98
Average discount rate high literacy	All	48	1.70
	Male	24	1.39
	Female	24	2.01
Average discount rate low literacy	All	37	1.43
	Male	20	0.995
	Female	17	1.95
Average income	All	85	R798.15
	Male	44	R699.48
	female	41	R904.04
Average household members	All	85	5.35
	Male	44	5.48
	Female	41	5.22
Average age	All	85	22.53 years
	Male	44	22 years
	Female	41	23.10 years

A total of 20 financial literacy questions form the financial literacy test. The average financial literacy score for the group is very low at 43%. The highest and lowest mark scored in the financial literacy test are 65% and 15% respectively. There is no significant difference between male and female respondents' level of financial literacy although the average financial literacy level of females is slightly higher. Male participants scored an average of 43% while female participants scored an average of 44%. This shows that the respondents generally lacked

financial literacy. This finding strengthens earlier findings by (Wagland and Taylor, 2009) who compared performance across gender of respondents that received equal treatment and found no difference in performance. In this case respondents are of generally a similar level of education under-graduate students pursuing Bachelor of Commerce Degree.

All the respondents' average discount rate is around 1.58. However, a major variation in time discount rates is found across gender. Male respondents exhibited an average time discount rate of about 1.21 compared to 1.98 reported from female respondents. The study categorized respondents that scored a mark above the average of all respondents as the high financial literacy group, whereas those that scored a mark below the average were categorised as the low financial literacy set. An investigation into the time discount rate of those who had high levels of financial literacy shows that female respondents' discount rates are much higher than that of male respondents. Female respondents have an average time discount rate of 2.01 compared to their male counterpart who have a time discount rate of 1.39. The low financial literacy group also shows that female respondents exhibit a higher average time discount rate (1.95), while male respondents' average time discount rate is lower at 0.995.

On average, respondents with higher levels of financial literacy had a higher average time discount rate (1.70) when compared to those with low levels of financial literacy (1.43) for the whole group. In general, comparing the high financial level set with the low level financial group shows that in all cases, female respondents have a high time discount rate compared to their male counterparts. This suggests that the female respondents that participated in the study are generally impatient and more willing to receive all the payment for their choices in the present time, that is, they are more likely to accept small sooner. These findings reveal variation in time preferences across gender and levels of financial literacy. In addition, respondents with higher financial literacy levels exhibited a higher average time discount rate when compared to those who had low levels of financial literacy.

On average, female respondents reported a higher average individual income and cash equivalence. The average individual income as well as cash equivalence reported by the whole group is approximately 798 rands with female respondents' average income pegged at 904 rands and that of males at 699 rands. The average family size for the whole group, males and females, was around five family members. The maximum age recorded for female respondents was 40 years compared to 29 years for males. The average ages for male as opposed to female respondents were 22 and 23 years respectively.

A t-test analysis of discount rate across gender shows a significant difference in the time preferences of female and male students at 5% level of significance. Elicited time preferences reveal that, on average, female students have higher discount rates than male students calculated as 1.98 and 1.2 respectively, suggesting that the female students are more impatient and more likely to opt for a payment after 2 weeks (present time pay-off or small sooner) instead of 6 weeks (future time pay-off or larger later).

5.2 Kernel densities for elicited time discount rates

Plotted Kernel densities show variations in time discount rates - more especially across gender and financial literacy level. Female respondents' time discounts represented on kernel densities are generally flattish while time discount rates for male respondents' kernel densities are peaked in the middle. To ensure smooth kernel densities, the data was presented in natural

logarithms. The smallest discount rate is set at 0.1 instead of 0 to make it possible to convert the rate in the natural logarithms and the largest is 5.

Figure a: Time discount rates graphs

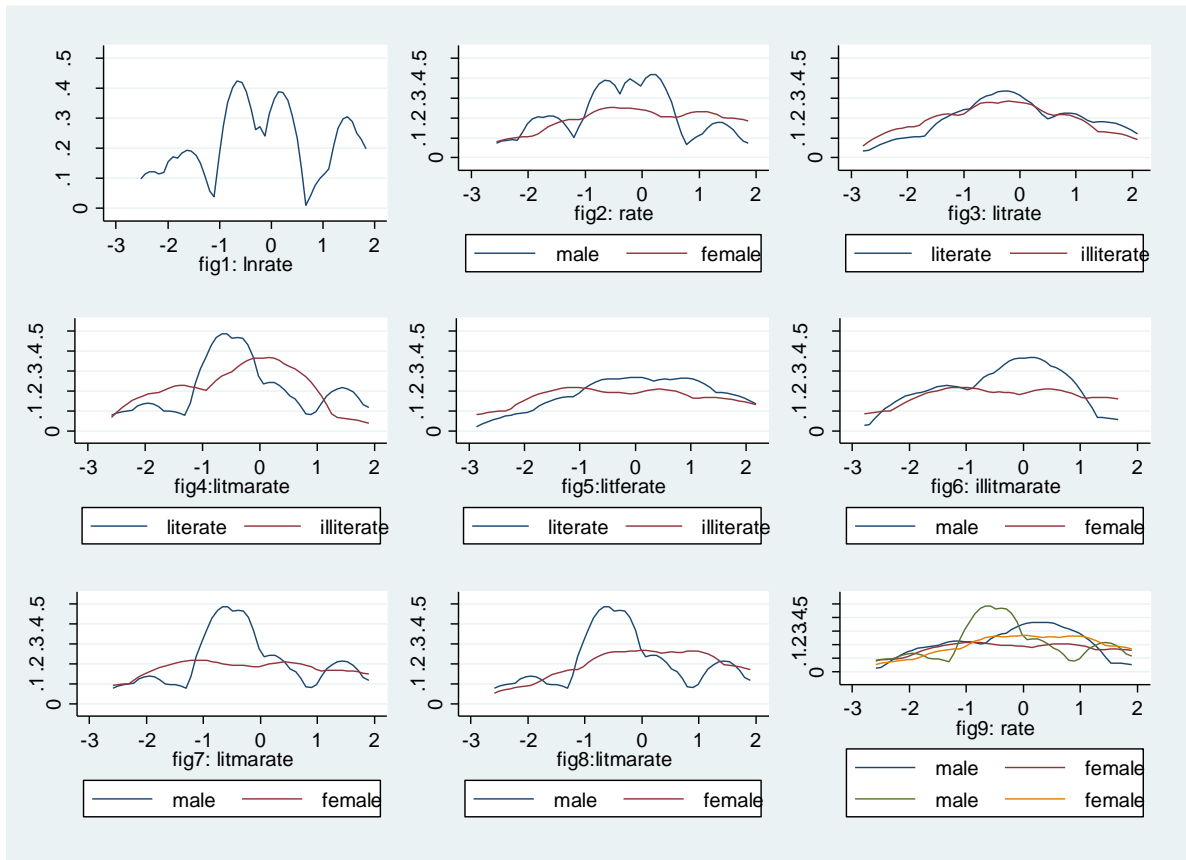


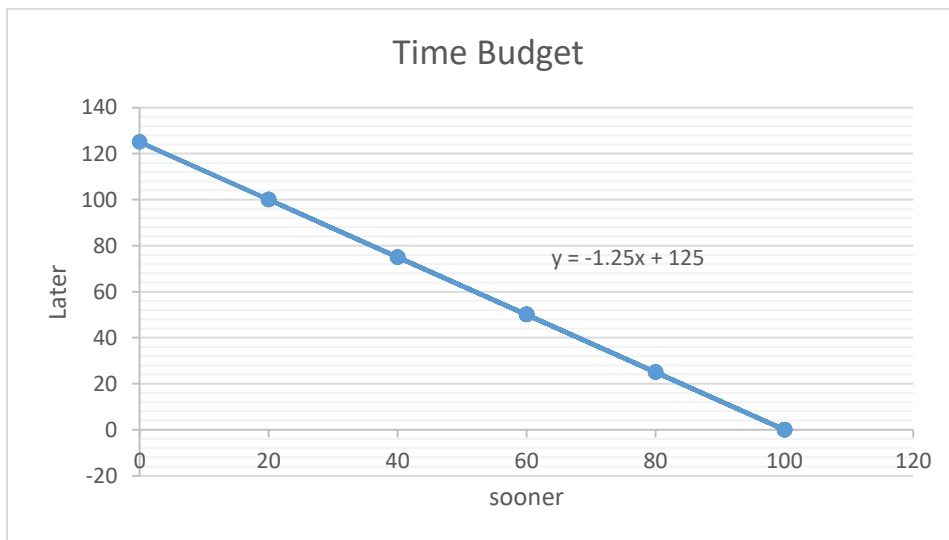
Figure *a* shows the distribution of time discount rates for all the respondents. The discount rates for the whole group are not normally distributed, but rather appear in leaps and bounds as shown in figure1. Figure 2 shows the variation among time discount rates across gender. Time discount rates of female respondents are flattish whereas those for male respondents are peaked in the middle. In Figure 3, time discount rates are fairly normally distributed. The Kernel densities represent variation of discount rates across level of financial literacy.

In Figure 4, time discount rates for male respondents show that the higher financial literacy group graph is more peaked at the centre. Time preferences kernel density graph for male respondents with lower levels of financial literacy were comparatively flatter. Figure 5 represents the time preferences of female respondents with higher and lower financial literacy levels, their graphs are generally flatter. In Figure 6, male respondents with low financial literacy level are compared with female respondents with higher levels of financial literacy. Female time discount rates are flatter compared to those of male counterparts. Figure 7 represents higher financial literacy male respondents compared with low financial literacy females. Female discount rates are flatter compared to fairly peaked male respondents graph. Figure 8 compares higher financial literacy level males and female respondents. Female respondents have flatter time discount rates than males. Figure 9 represents all time discount rates elicited in one display.

5.3 Time Budget

A graphical representation of simple binary choices made by subjects and the equivalent pay-off provided a time budget (TB) shown in Figure *b*. All respondents chose optimal choices that maximized their utility subject to the total return they could earn from their choices. In this instance, all respondents allocated all the ten tokens into two columns. During quota random sampling, most of the subjects were eager to pick the winning coupon, an aspect which reveals their need to maximize their utility. Several researchers have used the Convex Time Budget (CTB) point due to its ease of understanding by subjects, making it an appropriate tool to elicit preferences (Alan and Ertac, 2015; Andreoni *et al.*, 2015). The CTB is known to be a better measure of intertemporal choice when compared with the double multiple price list (DMPL) used by Andersen *et al.* (2008). The corner solution provided by the TB has a predictive power of individual impatience or patience. It also forecasts the demand theory as well as the equality of an individual in allocating income over periods (Andreoni *et al.*, 2015). A marginal rate of substitution of 1.25, shows the return the subjects could earn in the event that they were patient enough to receive the pay-off after 6 weeks.

Figure *b*



The return for a subject who is patient enough to receive all pay-off after 6 weeks converted per annum is approximately 217%. This means that subjects who collected all their pay-off in 2 weeks' time had a very high discount rate of the present pay-off. The maximum pay-off a participant could get in two weeks was 100 rands (7.7 USD) if all tokens were allocated in Column A, while those that collected all their pay-off after 6 weeks collected a maximum of 125 rands (9.7 USD) if all the tokens were allocated in Column B, assuming an exchange rate of 1USD: 12.99 rands.

5.4 Regression analysis

5.4.1 Time preferences and financial literacy level

The study investigates the baseline determinants of the time discount rate (Table 2). Five out of seven regression models have a significant alpha confirming that the variance is significantly different from the mean which allows the use of a Negative Binomial regression model. Female respondents have a higher discount rate compared to male counterparts. The first regression

confirms that there is a significant variation in time discount rate across gender. A higher time discount rate for female respondents compared to their male counterparts might be due gender disparities and girl child challenges regarding finances. The findings are contrary to a conclusion reached by Castillo et al., (2011) that boys were more impatient than girls in a 2008 study on time preference in the US. The other variable that significantly influenced time discount rate is the highest level of education in the household. Given that the respondent is from a household with the highest level of education being less than matric, the time discount rate for a respondent from a household with highest level of education of matric, diploma or certificate and degree is likely to be significantly higher. This reveals that the highest level of education in a household significantly influences respondent's level of patience. This confirms findings by (Smith and Barboza, 2014), who concluded that time preferences can be influenced by the parent/guardian's level of education.

An investigation into the respondents with higher level of financial literacy shows that the time discount rate of respondents from households with the highest level of education of a matric, diploma or certificate and degree are more likely to be significantly higher. There is no significant difference between time discount rates of female and male respondents with higher levels of financial literacy suggesting that if both males and females have higher levels of financial literacy their time preferences could be similar. Turning to the regression analysis focusing on respondents with lower levels of financial literacy, female respondents time discount rates are significantly higher compared to those of their male respondents. The time discount rate also significantly increased given that the respondents are from a household with the highest level of household education of matric, diploma/certificate and degree. Findings suggest that highest level of education in a household influences time preferences of the respondents. Further, it is concluded that time discount rate of female respondents tends to significantly decrease as the age of the respondent increases at 10% level. Meaning older female respondents are more likely to be patient or willing to accept a larger later.

The highest level of education in a household is the only variable that is concluded to be influencing discount rates of female respondents with a higher level of financial literacy. The time discount rate significantly increases if the respondents are from households with the highest level of education as matric, diploma or certificate and degree. The discount rates of female respondents with lower levels financial literacy significantly decreases at 1% level as age increases. This shows that older female respondents in the cohort are more patient, revealing that as one grows older even if one has low levels of financial literacy, one would have an understanding of the value of money and would be willing to wait to receive a larger later. Their discount rates significantly increased if they belonged to households with the highest level of education a matric and a degree. Discount rates of female respondents with lower level of financial literacy significantly increases at 10 % level as income increases. Higher income makes respondents in this group impatient. This might indicate that female respondents with higher income in this cohort were not willing to wait up to six weeks to receive a future income (larger later).

Table 2 : Negative Binomial Regression: Time discount rate

	All	all_literate	all_low_lit	high_lit_female	low_lit_female	high_lit_male	low_lit_male
female	0.57*** (0.216)	0.33 (0.309)	0.78*** (0.291)				
age	-0.028 (0.032)	0.00035 (0.064)	-0.055* (0.032)	-0.027 (0.080)	-0.11*** (0.036)	0.041 (0.083)	0.025 (0.109)
family_size	0.067 (0.048)	0.062 (0.076)	0.077 (0.060)	0.050 (0.105)	0.045 (0.106)	0.20* (0.110)	0.076 (0.053)
matric	1.70*** (0.324)	1.64*** (0.420)	1.97*** (0.316)	2.89*** (0.474)	1.97*** (0.696)	0.10 (0.616)	1.50** (0.727)
Dip/cert	2.00*** (0.480)	2.07*** (0.554)	1.48** (0.583)	1.95*** (0.660)	1.09 (1.277)	2.15*** (0.459)	1.54* (0.893)
degree	1.68*** (0.324)	1.21*** (0.448)	2.39*** (0.417)	2.02*** (0.547)	2.98*** (0.776)	1.00** (0.420)	1.39 (0.941)
lincome	0.068 (0.110)	0.099 (0.139)	0.18 (0.187)	0.11 (0.183)	0.39* (0.223)	0.59*** (0.222)	0.10 (0.214)
perceptions	0.25 (0.159)	0.020 (0.291)	0.30 (0.210)	-0.17 (0.484)	0.64 (0.427)	-0.57* (0.328)	0.20 (0.132)
ltest	0.028 (0.393)	-0.37 (1.236)	-0.36 (0.726)	0.085 (1.568)	0.33 (1.059)	-4.41** (2.108)	-1.54** (0.665)
_cons	-1.71 (1.224)	-1.21 (3.198)	-1.62 (1.388)	-2.30 (4.328)	-1.92 (2.291)	4.62 (4.296)	-0.30 (3.924)
lnalpha _cons	-1.14*** (0.243)	-1.25*** (0.279)	-1.99* (1.036)	-1.49** (0.603)	-1.47 (1.336)	-15.9*** (1.109)	-37.4 (.)
N	85	48	37	24	17	24	20

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A regression analysis on male respondents with higher levels of financial literacy shows that the highest level of education in a household significantly influences their time preferences for all the education levels analysed. Financial literacy test score also significantly influenced time preferences of male respondents with higher levels of financial literacy. A higher test score is associated with a lower time discount rate for male respondents. The findings are similar to what was concluded by Pol (2011) where high levels of financial literacy were associated with lower discount rate for individuals. Further, high income level is associated with a high time discount rate suggesting respondents with high income from this group are generally impatient.

Other variables that were found to be weakly significant in influencing time preferences are perceptions and family size. An analysis of all male respondents with low levels of financial literacy indicates that given that one is from a household with the highest level of education less than matric, the time discount rates of respondents from households with the highest level of education of matric and degree is more likely to be significantly higher. On the other hand, as the test score increases, the discount rate of respondents with a lower level of financial literacy decreases significantly. The findings submit that for male students, time preferences are influenced by financial literacy. This conclusion could not be confirmed from all female respondents. This might imply that financial literacy influenced time preferences of male respondents only in this study.

5.4.2 Time preferences and financial literacy

A parsimonious regression analysis on time preference and financial literacy could not confirm the impact of financial literacy on time discount rates (Table 3). All the regressions analyses have a significant alpha showing that the variance is significantly different from the mean, confirming the rational of using the Negative Binomial regression instead of Poisson regression analysis. What is evident in all the regression analyses is the significance of highest level of education in a household on influencing time preferences. In all cases investigated in Table 3 the highest level of education in a household of matric, diploma/certificate and degree significantly influence time preferences. Findings confirm that the respondent's state of the world critically impacts on how they make choices over time. A regression analysis for all males also concludes that time preferences are influenced by family size, a finding that also confirms that the state of the world where one exists is important in determining one's intertemporal choices.

Table 3: Negative Binomial Regression: Time discount rate

	all	male	female	Male1	female1	all_female	all_male	all1
Ltest_score	0.071 (0.374)	0.030 (0.477)	0.063 (0.568)	-0.061 (0.485)	0.12 (0.560)	0.23 (0.601)	-0.14 (0.475)	0.028 (0.393)
matric				1.08*** (0.380)	2.45*** (0.195)	2.54*** (0.272)	1.25** (0.500)	1.70*** (0.324)
Dip/cert				1.87*** (0.473)	1.57*** (0.191)	1.81*** (0.413)	2.29*** (0.636)	2.00*** (0.480)
degree				1.17*** (0.322)	2.28*** (0.267)	2.43*** (0.359)	1.56*** (0.506)	1.68*** (0.324)
age						-0.044 (0.036)	-0.022 (0.071)	-0.028 (0.032)
family_size						0.051 (0.076)	0.12** (0.060)	0.067 (0.048)
lincome						0.0097 (0.140)	0.24 (0.161)	0.068 (0.110)
perceptions						0.20 (0.292)	0.075 (0.165)	0.25 (0.159)
_cons	0.31 (0.797)	0.13 (0.958)	0.55 (1.236)	-0.86 (1.137)	-1.87 (1.198)	-1.52 (1.695)	-2.57 (2.144)	-1.71 (1.224)
lnalpha _cons	-0.74*** (0.182)	-1.45** (0.658)	-0.57*** (0.215)	-2.11** (1.013)	-0.78*** (0.273)	-0.88*** (0.316)	-2.80* (1.465)	-1.14*** (0.243)
<i>N</i>	85	44	41	44	41	41	44	85
<i>R</i> ²								

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.4.3 Time preferences and financial literacy interacted

In order to carry out a robust investigation of variables that significantly influence time preferences and financial literacy jointly, an interacted variable is created. The variable is calculated by multiplying financial literacy score with the time discount rate. The interaction of the two variables sum into a continuous dependent variable which permits us to run an Ordinary Least Square regression (Table 4). In the first regression analyses, all the respondents are included. The regression analysis confirms that females' time discount rate tends to be significantly higher at 5% level than that of the male respondents. A confirmation that if we considered time preference choices given an individual's financial literacy level, gender differences significantly influence outcomes. The highest level of education in a household significantly influence financial literacy-time discount (FT) variable. The highest level of education in a household that significantly influenced the variable are matric, certificate/diploma and degree showing that the state of the world in which respondents lived significantly influences their intertemporal choices.

In the higher financial literacy group, the highest level of education in a household which significantly influence the FT variable are matric and Diploma/certificate. At higher levels of financial literacy gender difference did not significantly influence FT variable. These findings show that if both female and male respondents attained higher levels of financial literacy gender differences would disappear. A regression analysis of all respondents with low financial literacy indicate that gender differences significantly influence FT variable. At low levels of financial literacy gender differences are prominent. Another variable that influences FT variable at low levels of financial literacy is the highest level of education in a household of degree and matric to a lesser extent.

Only highest level of education in household of matric significantly influence FT variable for female respondents, while age weakly significantly influence FT variable for female respondents with low levels of financial literacy. Diploma/certificate and degree significantly influence FT variable for male respondents with higher levels of financial literacy. No variable is concluded to be influencing FT variable for male respondents with lower levels of financial literacy. When the respondents are split into males and females with lower or higher levels of financial literacy. The highest level of education in a household only significantly influence FT variable for respondents with higher levels of financial literacy. There findings are in line with conclusion arrived at by Sabri et al., (2010), students who received financial literacy from their parents were found to be financially literate. The study findings reveal that the highest level of education in a household significantly influences FT variable.

Table 4: OLS Regression: Time discount rate and financial literacy interacted

	all	all_literate	all_low_lit	high_lit_female	low_lit_female	high_lit_male	low_lit_male
female	0.38** (0.171)	0.25 (0.307)	0.39** (0.183)				
age	-0.029 (0.025)	-0.0073 (0.064)	-0.031 (0.023)	-0.040 (0.099)	-0.078* (0.034)	-0.044 (0.081)	0.0094 (0.032)
family_size	0.015 (0.036)	0.036 (0.070)	0.025 (0.037)	0.033 (0.134)	0.032 (0.132)	0.050 (0.073)	0.024 (0.020)
matric	0.62*** (0.176)	0.80*** (0.282)	0.43* (0.215)	1.55** (0.660)	0.28 (0.398)	0.19 (0.236)	0.36 (0.303)
Dip/cert	0.91** (0.415)	1.20* (0.611)	0.34 (0.265)	0.58 (0.884)	-0.35 (0.998)	1.68** (0.738)	0.33 (0.354)
degree	0.54*** (0.167)	0.41 (0.261)	0.68** (0.252)	0.63 (0.599)	0.88 (0.789)	0.39* (0.220)	0.34 (0.368)
lincome	0.12 (0.095)	0.10 (0.163)	0.079 (0.098)	0.17 (0.266)	0.34 (0.209)	0.26 (0.226)	0.040 (0.088)
perceptions	0.14 (0.109)	0.0077 (0.290)	0.094 (0.098)	-0.22 (0.604)	0.26 (0.241)	-0.28 (0.288)	0.067 (0.050)
_cons	-0.15 (0.604)	-0.50 (1.267)	-0.064 (0.530)	-0.32 (2.117)	0.10 (1.250)	-0.38 (1.970)	-0.61 (1.185)
<i>N</i>	85	48	37	24	17	24	20
<i>R</i> ²	0.132	0.146	0.246	0.200	0.337	0.407	0.152

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In all cases it is concluded that the highest level of household education causes respondents to be impatient, since their time discount rate is more likely to increase. The study could not confirm whether financial literacy influences time preferences although there is some evidence on male respondents across financial literacy level. Other variables that are concluded to influence time preferences are income, age, family size, and perceptions to a lesser extent. People operating in a similar environment may achieve different life outcomes because of the state of the world that they live in. Individuals may be patient or impatient because of their life conditions. Being impatient may mean that an individual has an alternative investment venture that they would want to put money into. People with fewer options of saving money are more likely to be patient. Consumers achieve different life outcomes due to variation in time preferences.

6. CONCLUSION

The study uses a questionnaire that included a simple binary experimental game of tokens (that summed into a time budget) and a financial literacy test. Time discount rates for respondents with more or less financial literacy were all significantly influenced by the family's highest level of education. These findings reveal that family educational status plays a vital role in time preference choices of individuals. Elicited time discount rates from the experimental game also show that female respondents' time discount rates were higher than that of their male counterparts - reflecting that females are more impatient especially if they belong to a low financial literacy level group. The findings might explain how gender differences impact time preferences. Further, this may explain the financial challenges faced by the girl child. The study confirmed the impact of financial literacy on time preferences of male respondents but found no impact of financial literacy on time preferences for female respondents. A robust check using OLS model on the FT variable confirms that the highest level of education significantly influences time preferences, especially for students with higher level of financial literacy. Other variables concluded to be significantly influencing respondents' time preferences are age, income, perceptions and family size. It is critical to understand time preferences of individuals as they play an important role on perseverance and patience - which are vital for future welfare and investment choices. The findings are not exhaustive; a deeper investigation into how household level of education influences time preferences is required. The list of independent variables can be stretched to include more characteristics. More so, factors that tend to increase time discount rates for female respondents need further exploration. It will be important to understand how respondents react to higher and low time preference incentives at varying time stretch. Further research may investigate whether time preferences change as the level of income changes.

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